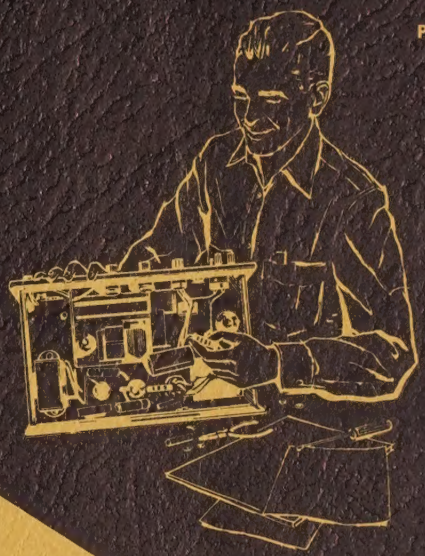
PRICE $1.00



Assembling
and Using Your...

Heathkit

DECADE RESISTANCE

MODEL DR-1

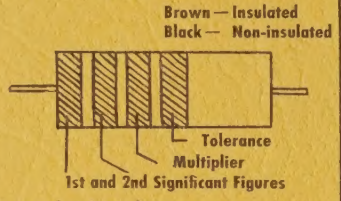
HEATH COMPANY
A Subsidiary of Daystrom Inc
BENTON HARBOR, MICHIGAN

595-19

STANDARD COLOR CODE — RESISTORS AND CAPACITORS

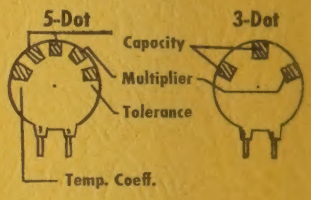
INSULATED UNINSULATED Color	FIRST RING BODY COLOR First Figure	SECOND RING END COLOR Second Figure	THIRD RING DOT COLOR Multiplier
BLACK	0	0	None
BROWN	1	1	0
RED	2	2	00
ORANGE	3	3	,000
YELLOW	4	4	0,000
GREEN	5	5	00,000
BLUE	6	6	000,000
VIOLET	7	7	0,000,000
GRAY	8	8	00,000,000
WHITE	9	9	000,000,000

AXIAL LEAD RESISTOR

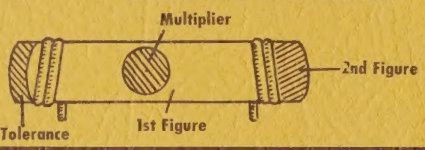


Wire wound resistors have 1st digit band double width

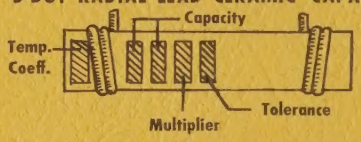
DISC CERAMIC RMA CODE



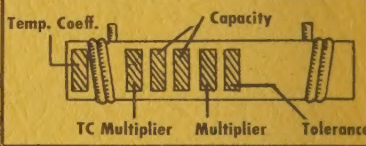
RADIAL LEAD DOT RESISTOR



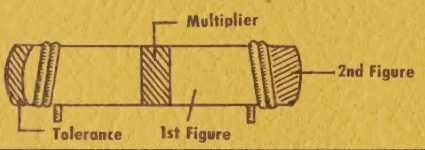
5-DOT RADIAL LEAD CERAMIC CAPACITOR



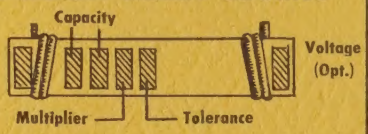
EXTENDED RANGE TC CERAMIC HICAP



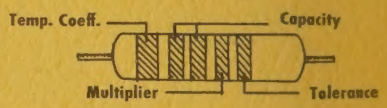
RADIAL LEAD (BAND) RESISTOR



BY-PASS COUPLING CERAMIC CAPACITOR



AXIAL LEAD CERAMIC CAPACITOR



The standard color code provides all necessary information required to properly identify color coded resistors and capacitors. Refer to the color code for numerical values and the zeroes or multipliers assigned to the colors used. A fourth color band on resistors determines tolerance rating as follows: Gold = 5%, silver = 10%. Absence of the fourth band indicates a 20% tolerance rating.

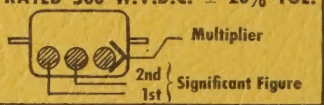
The physical size of carbon resistors is determined by their wattage rating. Carbon resistors most commonly used in Heathkits are ½ watt. Higher wattage rated resistors when specified are progressively larger in physical size. Small wire wound resistors ½ watt, 1 or 2 watt may be color coded but the first band will be double width.

MOLDED MICA TYPE CAPACITORS

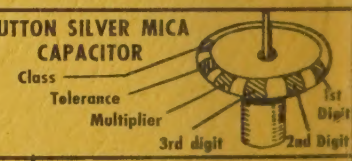
CURRENT STANDARD CODE

JAN & 1948 RMA CODE

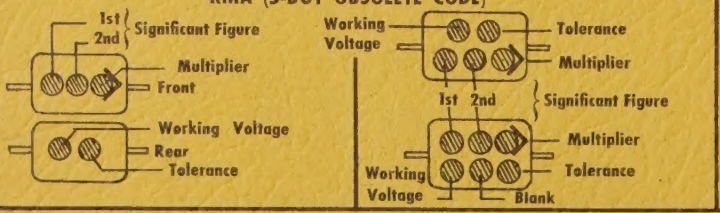
RMA 3-DOT (OBSOLETE) RATED 500 W.V.D.C. ± 20% TOL.



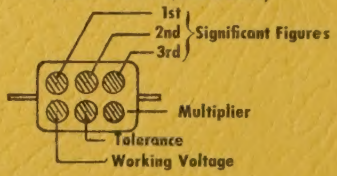
BUTTON SILVER MICA CAPACITOR



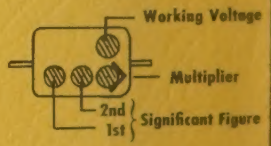
RMA (5-DOT OBSOLETE CODE)



RMA 6-DOT (OBSOLETE)

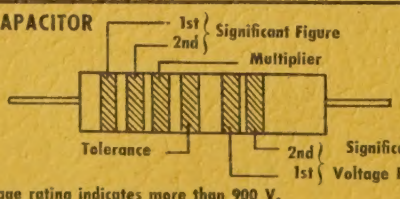


RMA 4-DOT (OBSOLETE)



MOLDED PAPER TYPE CAPACITORS

TUBULAR CAPACITOR

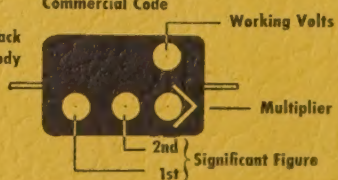


Normally stamped for value

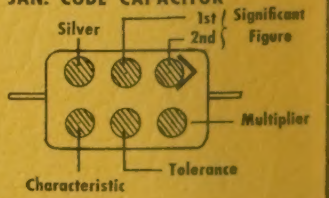
A 2 digit voltage rating indicates more than 900 V. Add 2 zeros to end of 2 digit number.

MOLDED FLAT CAPACITOR

Commercial Code



JAN. CODE CAPACITOR



The tolerance rating of capacitors is determined by the color code. For example: red = 2%, green = 5%, etc. The voltage rating of capacitors is obtained by multiplying the color value by 100. For example: orange = 3 × 100 or 300 volts. Blue = 6 × 100 or 600 volts.

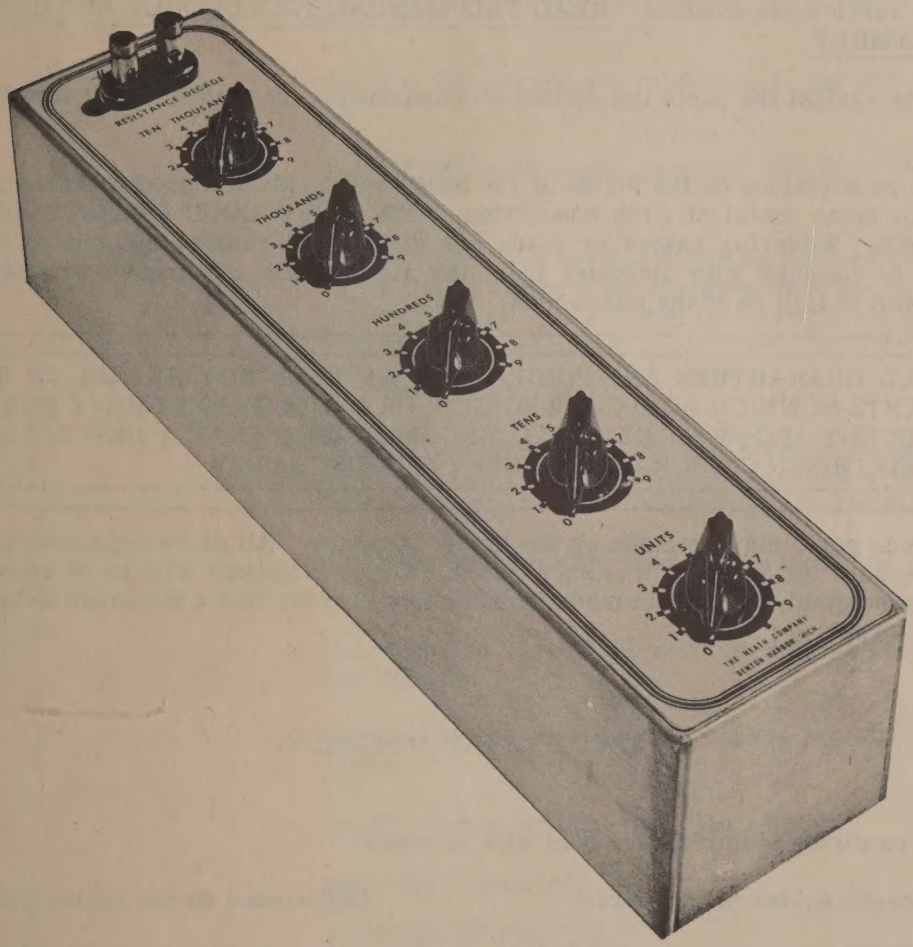
In the design of Heathkits, the temperature coefficient of ceramic or mica capacitors is not generally a critical factor and therefore Heathkit manuals avoid reference to temperature coefficient specifications.

Courtesy of Centralab

HEATHKIT

MODEL DR-1

DECADE RESISTANCE KIT



SPECIFICATIONS

Range	1 Ω to 99,999 Ω in one ohm steps
Components	Resistors: Precision - 1/2% accuracy Switches: Ceramic
Maximum Current	Units----------500 MA Tens----------150 MA Hundreds----------50 MA Thousands----------15 MA Ten Thousands------5 MA
Dimensions	14 1/2" x 3 3/8" x 3 3/8" Birch Cabinet

ASSEMBLY AND USE OF THE HEATHKIT

MODEL DR-1

DECADE RESISTANCE

This unit is designed as an accurate laboratory type of instrument and construction should be made with this end constantly in mind. Take time to do a top notch job of assembly so that years of dependable service are assured. READ THIS MANUAL THOROUGHLY AND COMPLETELY BEFORE ASSEMBLY.

Check all parts against the parts list so that no components are inadvertently thrown away with the packing.

Read the note on soldering on the inside of the back cover. Make a good mechanical joint with clean metal to clean metal at each connection. USE ONLY GOOD QUALITY ROSIN CORE RADIO SOLDER. Soldering pastes or acids are difficult to remove and minute amounts remaining tend to combine with moisture from the air to form a corrosive product which will ultimately result in failure of the instrument.

NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. WHEN IN DOUBT ABOUT SOLDER, IT IS RECOMMENDED THAT A NEW ROLL PLAINLY MARKED "ROSIN CORE RADIO SOLDER" BE PURCHASED.

Small changes in parts may be made by the Heath Company. All parts supplied will work just as well as the part for which it was substituted. All substitutions will be of equal or better quality than the original, and will be made if necessary in order that a minimum delay will occur in filling your order.

STEP BY STEP ASSEMBLY

Always refer to wiring pictorials for best wire location.

(S) means solder the connection (NS) means do not solder yet

SWITCHES--All five switches in this decade resistance are identical and should be basically wired exactly alike. The "units" switch will use the 1 Ω, 2 Ω, 3 Ω, and 6 Ω resistors. The "tens" switch will contain the 10 Ω, 20 Ω, 30 Ω, and 60 Ω resistors; the "hundreds" switch uses the 100 Ω, 200 Ω, 300 Ω and 600 Ω resistors. The 1 KΩ, 2 KΩ, 3 KΩ, and 6 KΩ resistors are connected to the "thousands" switch while the 10 KΩ, 20 KΩ, 30 KΩ, and 60 KΩ resistors are for the "ten thousands" switch.

Refer to diagram No. 1. Note that the switch connections are numbered clockwise and that the contact number is followed by a letter "R" or "F" which signify either the rear or front section of the switch. In wiring keep the switch oriented exactly in the position shown on this drawing.

Lugs not used on the switch are not shown in the diagrams. These extra lugs serve only to properly position the rotor.

"UNITS" SWITCH

( ) Commence wiring a switch by connecting one end of the 6 Ω resistor to switch lug #5R (S) and the other end of this resistor to lug #1R (NS). One end of 3 Ω resistor to lug #2R (NS) and then straight over to lug #1R (S). The other end of the 3 Ω resistor to lug #1F (NS).

( ) A length of bare wire to lug #1F (S) and diagonally across between the front and rear sections of the switch to lug #6R (S).

( ) Fasten one end of the 2 Ω resistor to switch lug #2F (S) and the other end to lug #3R (NS) and then straight over to lug #2R (S).

( ) The 1 Ω resistor connects to switch lug #3F (S) and the other end to lug #4R (NS) and then directly over to switch lug #3R (S).

( ) A length of busbar from switch lug #4F (S) and straight up to lug #4R (S). This completes basic wiring of the "units" switch.

As pointed out previously, the other switches are wired exactly as outlined but taking into account that the actual resistor values are multiples of the resistances on the "units" switch. However, for those who desire to follow precise step-by-step instruction, the following outlines detailed instructions for every switch.

"TENS" SWITCH

( ) Start wiring the "tens" switch by connecting one end of the 60 Ω resistor to switch lug #5R (S) and the other end of this resistor to lug #1R (NS) one end of 30 Ω resistor to lug #2R (NS) and then straight over to lug #1R (S). The other end of this resistor to lug #1F.

( ) A length of busbar to lug #1F (S) and diagonally across between the front and rear sections of the switch to lug #6R (S).

( ) Fasten one end of the 20 Ω resistor to switch lug #2F (S) and the other end to lug #3R (NS) and then directly over to switch lug #2R (S).

( ) The 10 Ω resistor connects to switch lug #3F (S) and the other end to lug #4R (NS) and then directly over to switch lug #3R (S).

( ) A length of busbar from switch lug #4F (S) and straight up to lug #4R (S).

The "tens" switch has now been basically completed.

"HUNDREDS" SWITCH

( ) Connect one end of the 600 Ω resistor to switch lug #5R (S) and the other end of this resistor to lug #1R (NS). One end of the 300 Ω resistor to lug #2R (NS) and then straight over to lug #1R (S). The other end of this 300 Ω resistor to lug #1F (NS).

( ) A length of busbar to lug #1F (S) and diagonally across between the front and rear section of the switch to lug #6R (S).

( ) Fasten one end of the 200 Ω resistor to switch lug #2F (S) and the other end to lug #3R (NS) and then straight over to lug #2R (S).

( ) The 100 Ω resistor connects to switch lug #3F (S) and the other end to lug #4R (NS) and then directly over to switch lug #3R (S).

( ) A length of busbar from switch lug #4F (S) and straight up to lug #4R (S). The "hundreds" switch has been basically wired.

"THOUSANDS" SWITCH

( ) Fasten one end of the 6 KΩ resistor to switch lug #5R (S) and the other end of this resistor to lug #1R (NS). One end of the 3 KΩ resistor to lug #2R (NS) and then straight over to lug #1R (S). The other end of this 3 KΩ resistor to lug #1F (NS).

( ) A length of bare wire to lug #1F (S) and diagonally across between the front and rear sections of the switch to lug #6R (S).

( ) Connect one end of the 2 KΩ resistor to switch lug #2F (S) and the other end to lug #3R (NS) and then straight over to lug #2R (S).

( ) The 1 KΩ resistor connects to switch lug #3F (S) and the other end to lug #4R (NS) and then directly over to switch lug #3R (S).

( ) A length of bare wire from switch lug #4F (S) and straight up to lug #4R (S). The "thousands" switch has now been basically wired.

"TEN THOUSANDS" SWITCH

( ) The last switch is wired by connecting one end of the 60 KΩ resistor to switch lug #5R (S) and the other end of this resistor to lug #1R (NS). One end of the 30 KΩ resistor to lug #2R (NS) and then straight over to lug #1R (S). The other end of this 30 KΩ resistor to lug #1F (NS).

( ) A length of bare wire to lug #1F (S) and diagonally across between the front and rear sections of the switch to lug #6R (S).

( ) Fasten one end of the 20 KΩ resistor to switch lug #2F (S) and the other end to lug #3R (NS) and then straight over to lug #2R (S).

( ) The 10 KΩ resistor connects to switch lug #3F (S) and the other end to lug #4R (NS) and then directly over to switch lug #3R (S).

( ) A length of busbar from switch lug #4F (S) and straight up to lug #4R (S). All five switches are ready for panel installation.

FINAL CONSTRUCTION

The binding posts are mounted as shown in the drawing, with assembly coming through from the front of the panel. A fiber washer, flat metal washer, solder lug, lockwasher, and nut go on in that order to hold the assembly to the panel.

Mount the switches, observing that the "ten thousands" switch goes next to the binding posts with the remaining switches fastening in sequential order so that the units switch mounts last in the space farthest away from the binding posts. Note positioning of switches shown by the main assembly diagram.

Start final wiring by connecting a length of busbar from binding post lug A (S) to the "ten thousand" switch lug X (S). A short length of busbar from lug Y on this same switch (S) to lug X on the "thousands" switch (S).

Fasten busbar to lug Y of the "thousands" switch (S) and to lug X of the "hundreds" switch (S). Another length of busbar to lug Y of the "hundreds" switch (S) over to lug X on the "tens" switch (S).

A short section of busbar from lug Y of the "tens" switch (S) to the X lug on the "units" switch (S). Connect an insulated wire from lug C on the "units" switch (S), along the panel to binding post B (S). The construction of your Heathkit Decade Resistance has now been completed.

Mount the panel on the birch cabinet and secure with the wood screws provided.

IN CASE OF DIFFICULTY IN CONSTRUCTION

Recheck the wiring. Most cases of trouble result from wrong connections. Often having a friend check the wiring will reveal a mistake consistently overlooked.

Check the switches to make sure they all index properly and make proper contact in every position.

Make sure that extraneous resistance due to solder parts, flux, dust and moisture has not been introduced in the circuit, particularly at the switches.

CIRCUIT DESCRIPTION

Special switches which properly connect combination of precision resistors in series are used in this instrument. An analysis of the "units" switch, for example, would show that on the 0 position the resistors are bypassed and the switch assembly connected to the next higher decade switch.

On position 1, the 1 Ω resistor is switched in. The 2 Ω resistor is used on position 2 and the 3 Ω is connected in position 3. For position 4, the 3 Ω and the 1 Ω resistors are connected in series while for position 5 the 2 Ω and the 3 Ω resistors are placed in series. The 6 Ω resistor is used on position 6 and when the switch is on position 7, the 1 Ω and 6 Ω resistor are in series. Position 8 finds the 6 Ω and 2 Ω resistor in series, while on position 9, the 6 Ω and 3 Ω resistors are connected in series.

APPLICATIONS

1. Calibration of instruments

2. Selection of proper meter multipliers

3. Bridge measurements

4. Experimental determination of proper circuit constants

CAUTION: Observe current limitation as outlined on specification page. This means the highest range decade switch in use (off of zero position) will determine maximum allowable current.

REPLACEMENTS

Material supplied with Heathkits has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Ocassionally improper instrument operation can be traced to a faulty tube or component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information:

A. Thoroughly identify the part in question by using the part number and description found in the manual parts list.
B. Identify the type and model number of kit in which it is used.
C. Mention the order number and date of purchase.
D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. Please do not return the original component until specifically requested to do so. Do not dismantle the component in question as this will void the guarantee. If tubes are to be returned, pack them carefully to prevent breakage in shipment as broken tubes are not eligible for replacement. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SERVICE

In event continued operational difficulties of the completed instrument are experienced, the facilities of the Heath Company Service Department are at your disposal. Your instrument may be returned for inspection and repair for a service charge of $3.00 plus the cost of any additional material that may be required. THIS SERVICE POLICY APPLIES ONLY TO COMPLETED INSTRUMENTS CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Instruments that are not entirely completed or instruments that are modified in design, will not be accepted for repair. Instruments showing evidence of acid core solder or paste fluxes will be returned not repaired.

The Heath Company is willing to offer its full cooperation to assist you in obtaining the proper operation of your instrument and therefore this factory repair service is available for a period of one year from the date of purchase.

SHIPPING INSTRUCTIONS

Before returning a unit for service, be sure that all parts are securely mounted. Attach a tag to the instrument giving name, address and trouble experienced. Pack in a rugged container preferably wood using at least three inches of shredded newspaper or excelsior on all sides. DO NOT SHIP IN THE ORIGINAL KIT CARTON AS THIS CARTON IS NOT CONSIDERED ADEQUATE FOR SAFE SHIPMENT OF THE COMPLETED INSTRUMENT. Ship by prepaid express if possible. Return shipment will be made by express collect. Note that a carrier cannot be held liable for damage in transit if packing, in HIS OPINION, is insufficient.

Prices are subject to change without notice. The Heath Company reserves the right to change the design of this instrument without incurring liability for equipment previously supplied.

WARRANTY

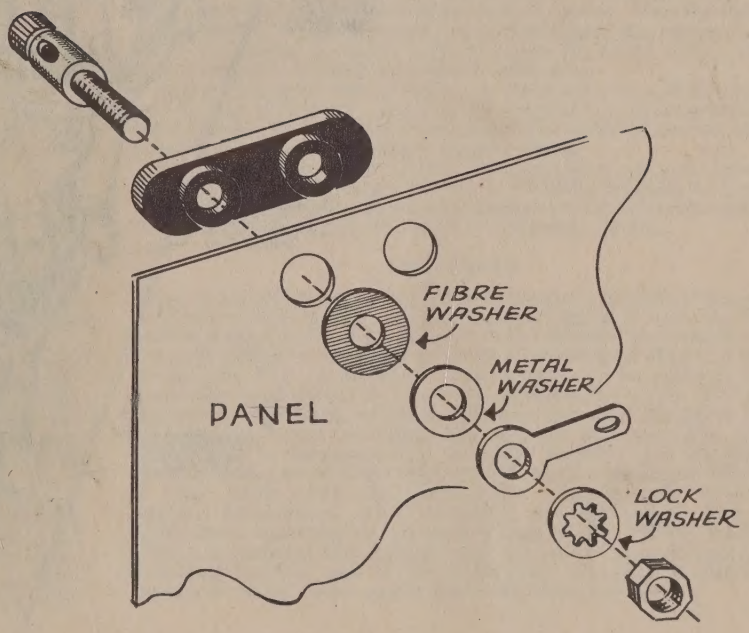
The Heath Company limits its warranty of any parts supplied with any Heathkit (except tubes, meters and rectifiers, where the original manufacturer's guarantee only applies) to the replacement within three (3) months of said part, which when returned with prior permission, postpaid, was, in the judgment of the Heath Company, defective at the time of sale.

The assembler is urged to follow instructions exactly as provided. The Heath Company assumes no responsibility or liability for any damages or injuries sustained in the assembly of the device or in the operation of the completed instrument.

HEATH COMPANY
Benton Harbor, Michigan

PARTS LIST

PART No.	PARTS Per Kit	DESCRIPTION
Precision Resistors		
2-1A	1	1 Ω 1 watt
2-2A	1	2 Ω 1 watt
2-3A	1	3 Ω 1 watt
2-1B	1	6 Ω 2 watt
2-4A	1	10 Ω 1 watt
2-5A	1	20 Ω 1 watt
2-6A	1	30 Ω 1 watt
2-2B	1	60 Ω 2 watt
2-7A	1	100 Ω 1 watt
2-8A	1	200 Ω 1 watt
2-9A	1	300 Ω 1 watt
2-3B	1	600 Ω 2 watt
2-10A	1	1 KΩ 1 watt
2-11A	1	2 KΩ 1 watt
2-12A	1	3 KΩ 1 watt
2-4B	1	6 KΩ 2 watt
2-13A	1	10 KΩ 1 watt
2-14A	1	20 KΩ 1 watt
2-15A	1	30 KΩ 1 watt
2-5B	1	60 KΩ 2 watt



Switches-Knobs		
63-22	5	10 position two deck rotary switch (with hardware)
462-19	5	Pointer knobs
Terminal Parts-Hardware		
75-1	1	Binding post insulator
427-1	2	Binding post base
250-20	2	Binding post thumbscrew
252-5	2	#10-32 nut
254-3	2	#10 lockwasher
253-6	2	Fiber washer
253-8	2	Nickel washer
259-3	2	#10 solder lug
250-12	6	#6 x 5/8 sheet metal screw
253-10	5	Control nickel washer
252-7	5	Control nut
254-4	5	Control lockwasher
250-22	5	Set screw
Wire-Panel-Cabinet		
340-3	2	18" lengths busbar
346-4	1	length spaghetti
203-M17F18	1	Panel
91-3	1	Cabinet

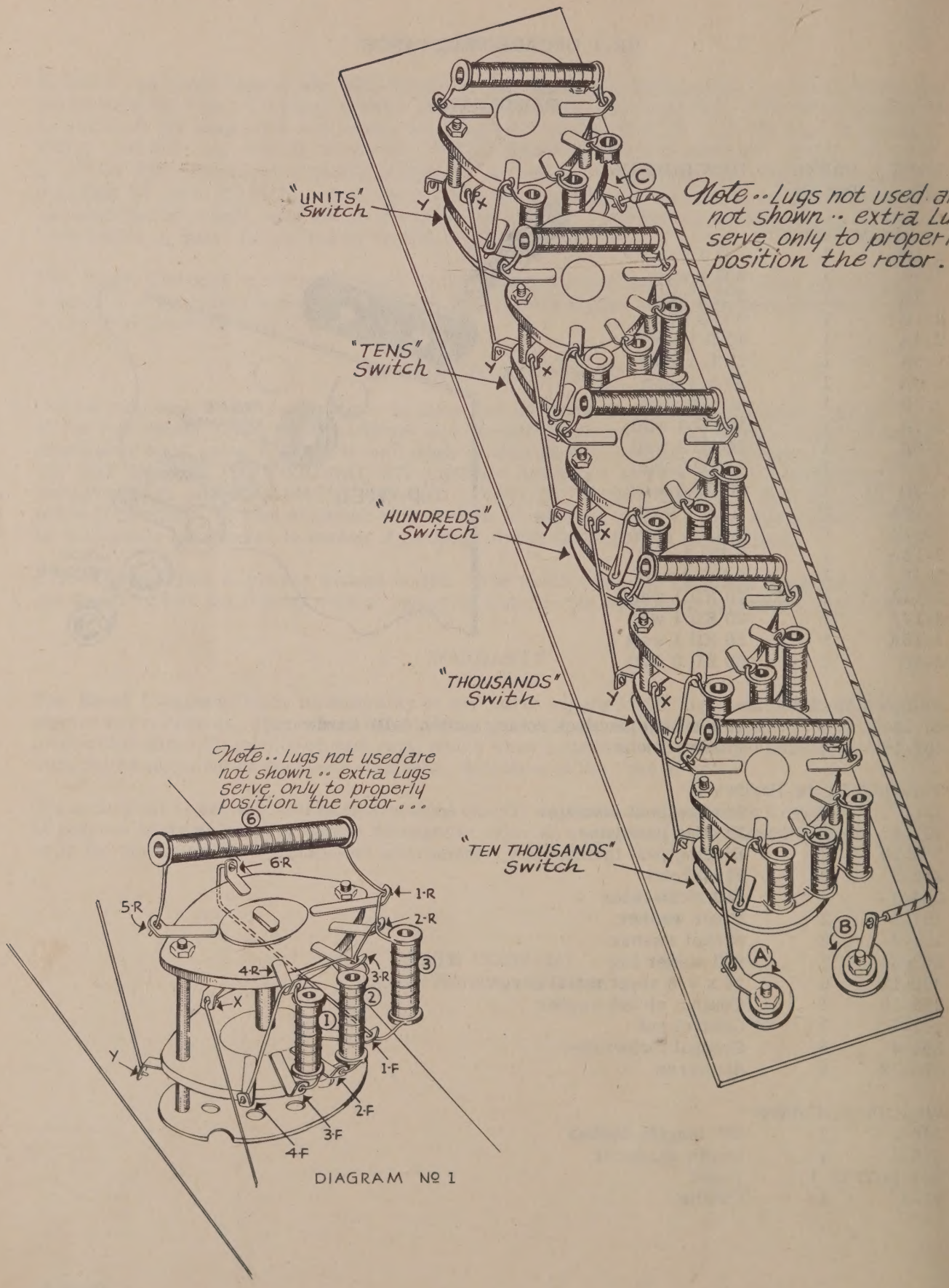

"UNITS" Switch
"TENS" Switch
"HUNDREDS" Switch
"THOUSANDS" Switch
"TEN THOUSANDS" Switch
Note .. Lugs not used are not shown .. extra Lugs serve only to properly position the rotor . . .
Note .. Lugs not used are not shown .. extra Lugs serve only to properly position the rotor . . .
6-R
1-R
2-R
3-R
4-R
5-R
X
Y
1-F
2-F
3-F
4-F
A
B
C

DIAGRAM Nº 1

HELPFUL KIT BUILDING INFORMATION

Before attempting actual kit construction read the construction manual through thoroughly to familiarize yourself with the general procedure. Note the relative location of pictorials and pictorial inserts in respect to the progress of the assembly procedure outlined.

This information is offered primarily for the convenience of novice kit builders and will be of definite assistance to those lacking thorough knowledge of good construction practices. Even the advanced electronics enthusiast may benefit by a brief review of this material before proceeding with kit construction. In the majority of cases, failure to observe basic instruction fundamentals is responsible for inability to obtain desired level of performance.

RECOMMENDED TOOLS

The successful construction of Heathkits does not require the use of specialized equipment and only basic tools are required. A good quality electric soldering iron is essential. The preferred size would be a 100 watt iron with a small tip. The use of long nose pliers and diagonal or side cutting pliers is recommended. A small screw driver will prove adequate and several additional assorted screw drivers will be helpful. Be sure to obtain a good supply of rosin core type radio solder. Never use separate fluxes, paste or acid solder in electronic work.

ASSEMBLY

In the actual mechanical assembly of components to the chassis and panel, it is important that the procedure shown in the manual be carefully followed. Make sure that tube sockets are properly mounted in respect to keyway or pin numbering location. The same applies to transformer mountings so that the correct transformer color coded wires will be available at the proper chassis opening.

Make it a standard practice to use lock washers under all 6-32 and 8-32 nuts. The only exception being in the use of solder lugs—the necessary locking feature is already incorporated in the design of the solder lugs. A control lock washer should always be used between the control and the chassis to prevent undesirable rotation in the panel. To improve instrument appearance and to prevent possible panel marring use a control flat nickel washer under each control nut.

When installing binding posts that require the use of fiber insulating washers, it is good practice to slip the shoulder washer over the binding post mounting stud before installing the mounting stud in the panel hole provided. Next, install a flat fiber washer and a solder lug under the mounting nut. Be sure that the shoulder washer is properly centered in the panel to prevent possible shorting of the binding post.

WIRING

When following wiring procedure make the leads as short and direct as possible. In filament wiring requiring the use of a twisted pair of wires allow sufficient slack in the wiring that will permit the twisted pair to be pushed against the chassis as closely as possible thereby affording relative isolation from adjacent parts and wiring.

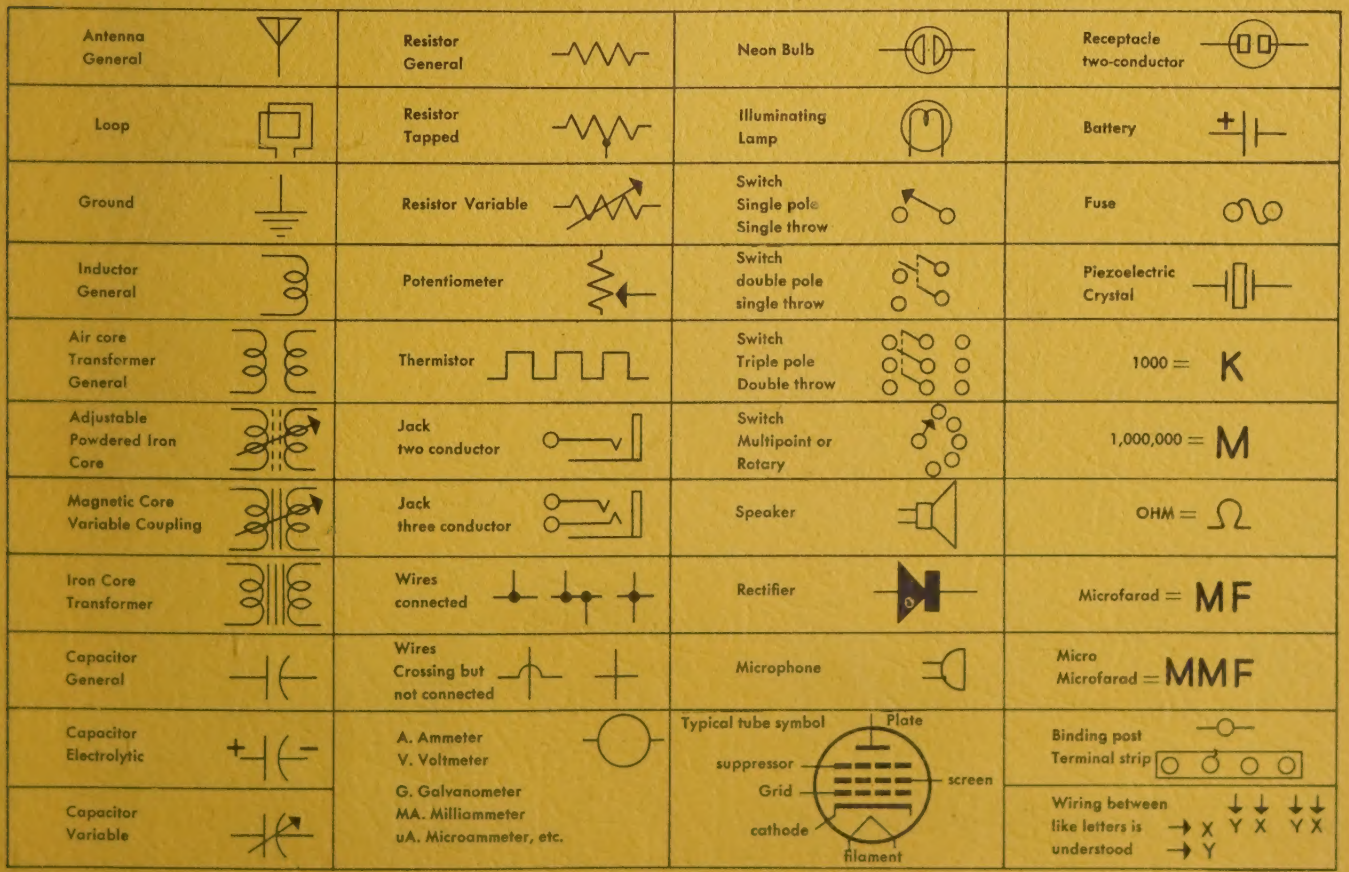
When removing insulation from the end of hookup wire, it is seldom necessary to expose more than a quarter inch of the wire. Excessive insulation removal may cause a short circuit condition in respect to nearby wiring or terminals. In some instances, transformer leads of solid copper will have a brown baked enamel coating. After the transformer leads have been trimmed to a suitable length, it is necessary to scrape the enamel coating in order to expose the bright copper wire before making a terminal or soldered connection.

In mounting parts such as resistors or condensers, trim off all excess lead lengths so that the parts may be installed in a direct point-to-point manner. When necessary use spaghetti or insulated sleeving over exposed wires that might short to nearby wiring.

It is urgently recommended that the wiring dress and parts layout as shown in the construction manual be faithfully followed. In every instance, the desirability of this arrangement was carefully determined through the construction of a series of laboratory models.

SOLDERING

Much of the performance of the kit instrument, particularly in respect to accuracy and stability, depends upon the degree of workmanship used in making soldered connections. Proper soldered connections are not at all difficult to make but it would be advisable to observe a few precautions. First of all before a connection is to be soldered, the connection itself should be clean and mechanically strong. Do not depend on solder alone to hold a connection together. The tip of the soldering iron should be bright, clean and free of excess solder. Use enough heat to thoroughly flow the solder smoothly into the joint. Avoid excessive use of solder and do not allow a flux flooding condition to occur which could conceivably cause a leakage path between adjacent terminals on switch assemblies and tube sockets. This is particularly important in instruments such as the VTVM, oscilloscope and generator kits. Excessive heat will also burn or damage the insulating material used in the manufacture of switch assemblies. Be sure to use only good quality rosin core radio type solder.



Courtesy of I. R. E.

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